

THURSDAY, JULY 20, 1905.

ARCTIC METEOROLOGICAL OBSERVATIONS.

The Norwegian North Polar Expedition, 1893-1896; Scientific Results. Edited by Fridtjof Nansen. Vol. vi. Published by the Fridtjof Nansen Fund for the Advancement of Science. Pp. xiv+659; 20 plates. (London: Longmans, Green and Co., 1905.) Price 36s. net.

IT is a misfortune that meteorological results demand so many figures for their discussion, and so much space for their exhibition. Vol. vi. of the Norwegian North Polar Expedition, dealing with the climatology of the area through which the *Fram* drifted in its memorable voyage, 1893-6, is a most interesting book, but its size and appearance might repel any but the most ardent meteorologist. The discussion of the observations has been undertaken by Prof. Mohn, of Christiania, and the arrangement is a model of clearness and efficiency. Prof. Mohn superintended the whole meteorological equipment, suggested the plan of work to be carried out during the voyage, and arranged with Captain Scott-Hansen the general management of the meteorological work. We imagine Prof. Mohn must be gratified with the success of his arrangements, and the intelligent interest which the officers of the expedition have shown in the work. Notwithstanding the severity of the climate, there is hardly a gap in the series of observations. At sea, the observations were taken at intervals of four hours, but for the greater part of the time the readings were made every two hours, with a regularity that compels admiration. The result is that we have, with very considerable accuracy, the climatological elements of a region in the circum-polar Arctic Ocean, where the surface of the earth during the whole time was of a unique homogeneous nature, consisting of a level of frozen water, remote from continents and islands, and with an uninterrupted free horizon.

The wind, particularly with regard to direction and velocity, is the first element discussed. To obtain a sufficiently long series of observations for investigation, Prof. Mohn divides the interval into three groups, a dark season when the sun was below the horizon, a sunny season during which the sun was above the horizon for practically twenty-four hours, and the equinoctial months, during which there was regular day and night. The discussion shows that during the dark season the wind shifts generally against the sun. Only during four hours in the twenty-four does the wind veer with the sun, while in the sunny period the wind veers with the sun, backing about six hours, divided into periods of two hours each at three different periods of the day. In the equinoctial months the backing and veering are equal, the wind shifting with the sun during the night and morning, and against the sun from 10 a.m. to 10 p.m. The diurnal period of the wind's direction is a phenomenon which still awaits an explanation, and the different direction of the shift of the wind in

the dark and in the sunny season seems to be of some importance for the solution of the problem. With reference to the velocity of the wind, it is shown to be greater when the sky is overcast than when it is clear. In the former case, the average velocity is 5.09 metres per second (11.4 miles per hour), and in clear weather only 3.54 metres per second (8 miles per hour). The greatest velocity recorded appears to be 40 miles an hour in February, 1896.

The discussions of the variations of temperature are very interesting, but the results drawn from them regarding the periods of the meteorological elements must of necessity be less trustworthy than if there had been a longer series of observations at disposal. It may therefore be premature to draw conclusions as to the connection between the different observed phenomena, and between those phenomena and their probable causes. The desirability of a longer period, and the character of the errors that can be introduced by the comparison of but few values, are shown very readily if we attempt to derive the month of lowest temperature from the figures given. The readings are centigrade, and show the mean temperature for each month:—

	January	February	March	April
1894	-35°72	-35°57	-37°08	-21°31
1895	-33°71	-37°18	-35°01	-28°89
1896	-37°33	-34°73	-18°89	-18°15
Mean	-35°59	-35°83	-30°33	-22°78

The great variation of temperature in March, 1896, making it nearly equal to that of April, demonstrates the uncertainty that must accompany any attempt to derive mean values from short periods. But the deductions drawn directly from the observations, and supported as they are in many instances by similar observations made in Arctic latitudes, are not liable to the same uncertainty. Among these results may be placed the following:—Throughout the dark winter months, when the sky is clear, the lowest temperature occurs in the day, the highest during the night. Generally, in the other months, we have the ordinary diurnal period. With the sky overcast, the diurnal period, with a minimum in the early morning hours and maximum after noon, is very well developed in all the months except January.

"The most striking feature," says Prof. Mohn, "seems to me to be the distinct diurnal period of the ordinary march in the winter and dark season, with the sky overcast and relatively higher temperatures. The inverted period with clear sky in the dark season seems to be due to the diurnal period of the wind's direction. The dark-season period with its stronger, south-easterly winds, is hardly to be accounted for by the radiation from the sun or sky."

The forms of cloud, the relative humidity, and the amount and character of precipitation are discussed at full length, but do not present results of unusual importance. With regard to the latter, however, it is not altogether uninteresting to notice that the number of days in a year on which rain is probable is 49, while snow may be expected on 157 days, and some form of moisture will be collected on 180 days.

Hail fell on only 5 days throughout the whole period. Rain can fall only from May to October, and July has the greatest number of rainy days, also it is the month which gives rise to the greatest amount of fog. Very considerable care was taken to determine the temperature of the Polar ice, but, naturally, much difficulty was experienced in recovering the thermometers from the bore-holes, in which they might be frozen fast, while during the summer, the viscous ice would close round them, requiring the thermometers to be dug out. Neither is it easy to remove the sources of error from the observations, especially from the effects of brine contained in the ice, which was apt to fill the bottom of the holes even during the coldest season, whilst during the summer all the holes were filled with briny or saline water, the salinity of which decreased inversely as the temperature. This brine percolated from a different level to that in which the thermometer was placed. In the winter time the temperature of the ice increased from the surface downward, and therefore the brine at the bottom of the hole was probably of too low a temperature. On the other hand, in the summer time, the ice near the surface was warmer than that lower down, and the brine would be less saline, and consequently lighter in the upper layers than in the deeper, so that in the summer time the temperature reading would again be too low. The result drawn from the observations is that the surface of the ice, in all months with the single exception of June, is warmer than the air. The difference is greatest in December, amounting to 16° F. The surface of the ice, being covered, except during a short time in summer, with snow, is protected from cooling by radiation upwards, and receives heat from the underlying warmer layers. This, no doubt, is the main factor in the explanation, though other causes are suggested by Prof. Mohn.

The book contains also an account of the meteorological observations made during the sledge expedition to Franz Josef Land in 1895-6. From this account we can quote only one remark, which illustrates the determination of the leader of the expedition to secure an unbroken series of observations.

"We had no lantern for the reading of the thermometer, and I tried in vain to construct one, which would not burn more oil than we could afford to use. But our eyes of course became gradually trained to see in the dark, and even in mid-winter, with no moonlight, there was so much light reflected from the snow that the column of the darkly coloured Metaxylol was dimly visible, and also the figures of the thermometer scale, but not the division marks."

Dr. Nansen therefore apologises for the absence of the decimal reading, which is missing about the time of new moon. The interest of the book is necessarily largely centred in the fact that the crew of the *Fram* laboured so diligently and so well to overcome the difficulties that were imposed upon them by the situation in which they were placed. To go up to the crow's nest to take additional readings of the instruments in dark, wintry weather seems to have been a source of positive enjoyment to those who took part in these observations.

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EUROPEAN AND ASIATIC GEESE.

The Geese of Europe and Asia. By Sergius Alpheraky. Pp. viii+198; 24 plates. (London: Rowland Ward, Ltd., 1905.) Price 3l. 3s. net.

AT the present day most works on ornithology of a general character are of little permanent value because the broad outlines of the northern fauna have already been adequately dealt with. What we want, and what we so seldom see, are complete life-histories of separate groups of birds, adequately illustrated and described by ornithologists who are both well acquainted with them in the field and are capable of summarising their labours in an accurate scientific account. To do this a very large series of birds must be collected, examined and digested, and this means years of travelling and study with little monetary reward as the result. Nevertheless, the works of such men are of great and permanent value, although their costly nature must ever be a constant drawback to the producer. No good form of colour printing is cheap, and as this is a *sine qua non* in works of this kind, the results can only pass into the hands of a public "fit but few."

The latest of these monographs is that of "The Geese of Europe and Asia," by Mr. S. Alpheraky, and the Russian naturalist is to be congratulated in giving us the first detailed account of this interesting and, we may say literally, confusing group of birds. It is an admirable treatise, full of research in field and museum, and the work of one who has carefully studied the subject from all points of view. There are twenty-four coloured plates by Mr. F. W. Frohawk, which are unfortunately only moderately successful. Twenty-one of these represent the different kinds of geese described by the author, and for the most part the lithography is weak and hard, and evidently does not do justice to the artist's careful work; whilst the three plates representing the bills of four various kinds are excellent, and will be of the greatest use both to sportsmen and naturalists in the determination of species. The frontispiece to the work represents the assemblage of white-fronted and red-breasted geese on a sandspit, and is from the brush of Dr. Sushkin. The idea of movement exhibiting the various attitudes into which these birds throw themselves is very fairly represented, but the technical work of painting and the drawing of some of the wings, as well as the general composition, leave much to be desired. It seems a thousand pities that chromolithography is a dying art, and that no firm in Europe is capable of turning out first-class work except W. Greve, of Berlin. For all we know, these drawings by Dr. Sushkin and Mr. Frohawk may have been soft and truthful representations of nature, but here we only see hard and black lines such as nature never shows.

Mr. Alpheraky is evidently a keen sportsman as well as a good naturalist, and he rightly holds a high view of the remarkable intelligence of this class of birds.

"Geese," he says, "afford one of the most difficult kinds of fowling. However cunning man may be, he